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Federal Communications Commission
Office of Secretary

Ex Parte

July 10, 1998

Ms. Magalie Roman Salas
Secretary
Federal Communications Commission
Mail Stop Code 1170
1919 M Street, N.W., Room 222
Washington, D.C. 20554

RE: CC Docket No. 98-91

In the course of recent Ex Parte meetings in the above referenced docket with the Office of Plans and Policy and the Planning Division of the Common Carrier Bureau, SBC was asked to provide its spectral requirements for ADSL services as it applies to loop qualification. The attached document "Spectral Requirements for ADSL in SBC's Unbundled Loops" details the requirements for unbundled loops as well as SBC's own ADSL service.

Please include this letter and the attachments in the record of these proceedings in accordance with Section 1.1206(a)(1) of the Commission's Rules.

Acknowledgment and date of receipt of this transmittal are requested. A duplicate transmittal letter is attached concerning this matter.

Respectfully submitted,

Lincoln E. Brown

CC: Bob Pepper
Elliot Maxwell
Jason Oxman
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Federal Communications Commission
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Spectral Requirements for ADSL in SBC's Unbundled Loops
ATTACHMENT 1

Twisted pairs used for digital subscriber loop services typically are housed within binder groups with other pairs for at least part of their run length. Within a binder group, electromagnetic coupling, termed crosswalk, will result in the signal from one pair generating noise onto other pairs. This crosswalk interference can often be a limiting factor in service performance. In order to ensure proper service performance, the spectral usage of services must be carefully managed.

In this context, SBC has chosen an ADSL solution that adheres to the American National Standards Institute (ANSI) T1.413 standard using the frequency division multiplexed (FDM) option. In particular, the letter ballot for Issue 2 of T1.413 (T1 LB 652) will be referenced. Selection of a T1.413-based solution leverages the significant body of work that had been performed on spectral compatibility during the evolution of this standard. The FDM option was selected in order to minimize the effect of near-end crosswalk (NEXT). When various transceivers are located very close to each other and share the same binder, the crosswalk generated by a transceiver will see very little attenuation before being applied to other transceivers. This can occur at either the network or subscriber end, and is quite likely at the network end. Thus it is preferable to minimize the spectral overlap of signals for various services. By using the FDM option, NEXT from the ADSL downstream will have little overlap with the ADSL upstream and ISDN, and have only partial overlap with HDSL.

For ADSL deployed in unbundled loops, the same issues relative to crosstalk apply. Therefore it is crucial that ADSL systems deployed in unbundled loops have spectral characteristics similar to a T1.413-compliant system using the FDM option. The spectral characteristics of an ADSL system are shown in Figures 1 and 2. In each, the spectrum is broken into three sections: the out-of-band response below the pass band (A, D), the pass band response (B, E), and the out-of-band response above the pass band (C, F). The T1.413 standard gives the spectral requirements for a system using the echo-cancelled option. This information can be used to define the characteristics of sections A, B, E, and F of figures 1 and 2. Additional requirements must be given for sections C and D.

Consider the upstream response in Figure 1. Sections A and B are defined in Figure 29 of T1 LB 652, along with sections 7.14.1 and 7.14.2. These parts of the letter ballot are repeated in Appendix A for reference. For the case of section C, however, SBC does not feel that the response in Figure 29 of appendix A is restrictive enough, and the resulting NEXT could unnecessarily degrade downstream performance. For the case of 10 interferers, the NEXT generated by HDSL and ISDN will reach the noise floor of -140 dBm/Hz at about 400 kHz (crosstalk models taken from appendix B of T1 LB 652). For the response of Figure 29, this value would not be reached until about 650 kHz. SBC requires that the band from 138 kHz to 416 kHz roll off at 32 dB/octave such that the NEXT due to the upstream ADSL signal shall reach the noise floor at 416 kHz. The requirements above 416 kHz follow a similar pattern to Figure 29, but with 915 kHz changed to 620 kHz. The overall requirements are given in Figure 3.

Next consider the downstream response of Figure 2. Sections E and F are defined in Figure 25 of T1 LB 652, along with sections 6.14.1 and 6.14.3. These parts of the standard are repeated in Appendix B for reference. Since Figure 25 of T1.413 assumes the echo-cancelled option, it cannot be used to define section D of Figure 2. Echo cancelled systems can severely disrupt the service of customers on non-echo cancelled systems. SBC has determined that the degradation due to NEXT from the downstream ADSL signal is acceptable if it follows a 36 dB/octave roll off from 160 kHz down to 80 kHz. Below 80 kHz, a roll off of approximately 4.6 dB/octave is used to ensure that the level is 92.5 dBm at 4 kHz (a straight line fit in dB). The overall requirements are given in Figure 4.

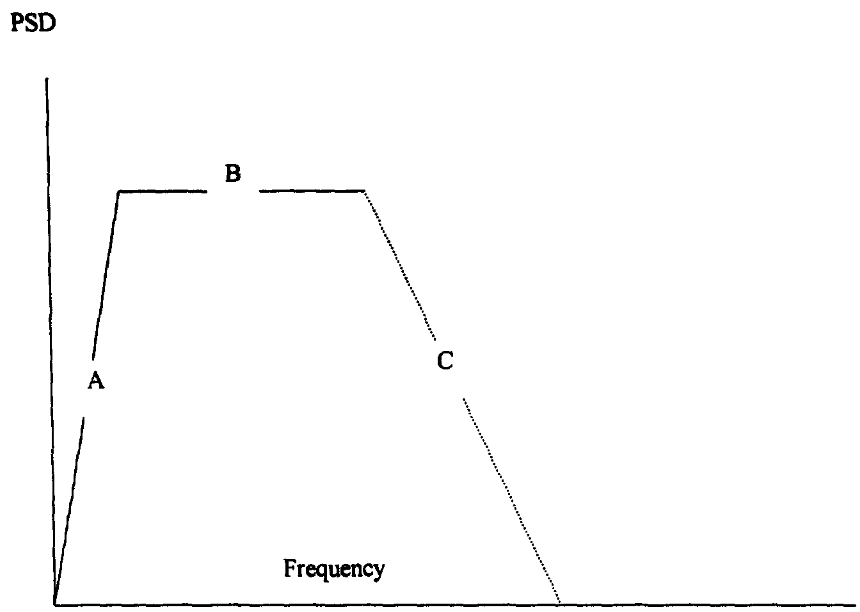


Figure 1: Upstream spectrum

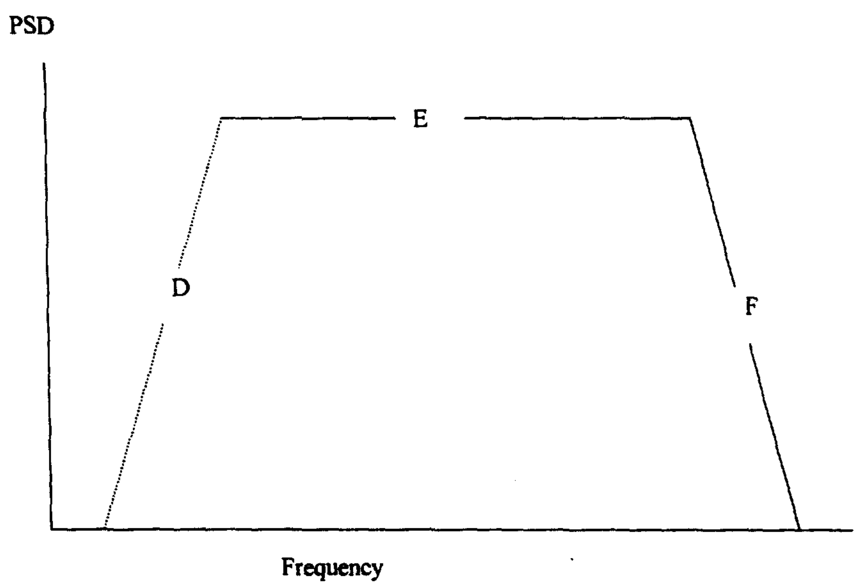


Figure 2: Downstream spectrum

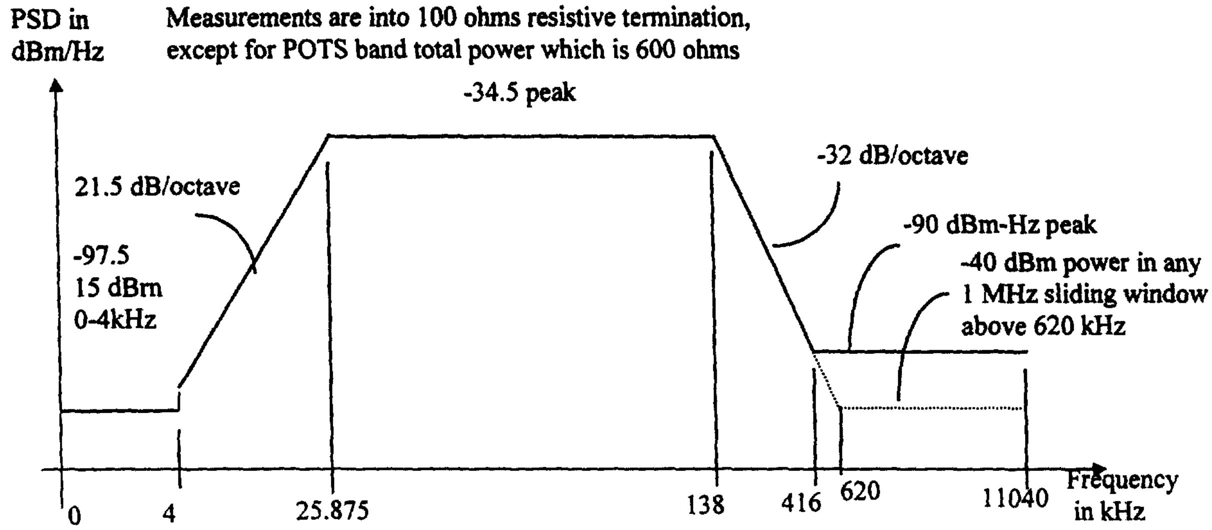


Figure 3: Upstream requirements

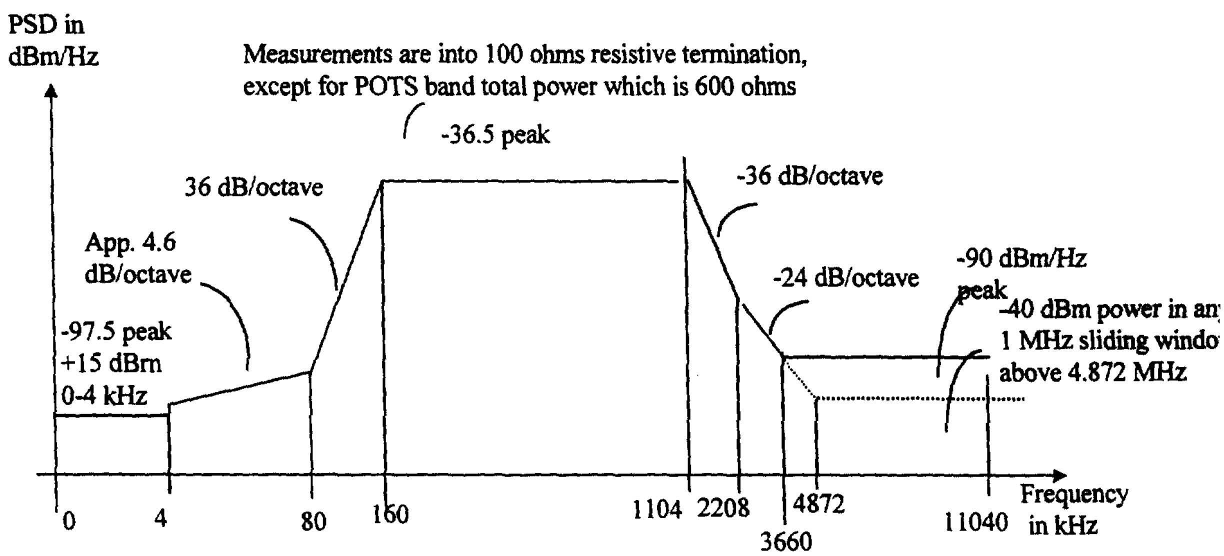
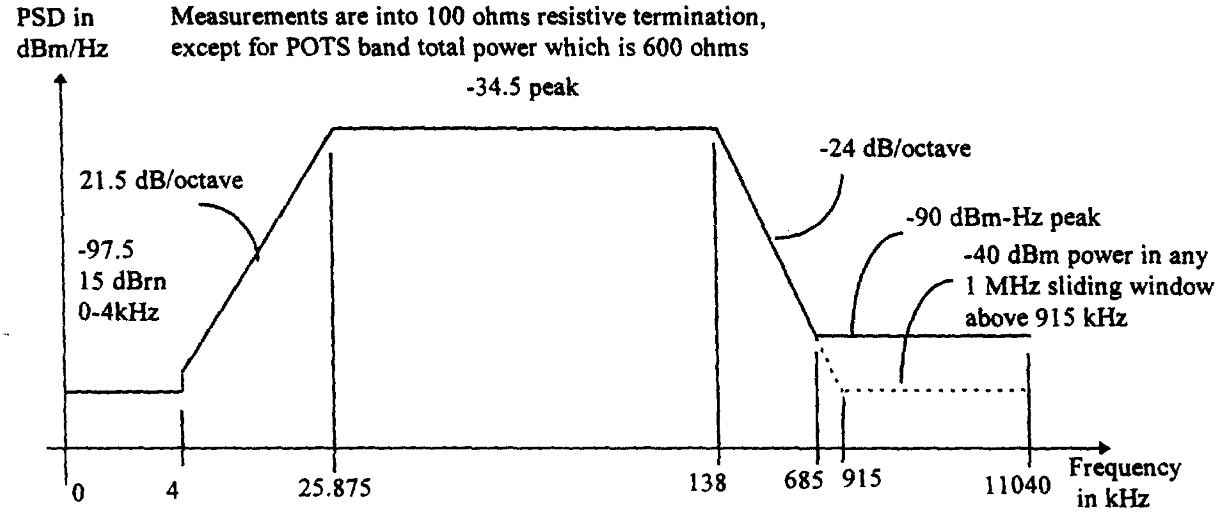


Figure 4: Downstream requirements

Appendix A: Upstream Spectral Response from T1 LB 652

7.14 Transmitter spectral response



FREQUENCY BAND, kHz	EQUATION FOR LINE, dBm/Hertz
0 - 4	-97.5, +15 dBrn 0-4 kHz
>4 - 25.875	-92.5 + 21.5*log (f/4)/log(2)
25.875 - 138	-34.5
138 - 685	-34.5 - 24*log(f/138)/log(2)
685 - 11040	-90, , with -40 dBm power in any 1 MHz sliding window above 915 kHz

Figure 29 – ATU-R transmitter PSD mask

Figure 29 shows a PSD mask for the transmitted signal. For purposes of this specification, the pass band is defined as the frequency range over which the modem transmits. The low frequency stop band is defined as the voice band.

7.14.1 Pass band PSD and response

The average PSD within the used passband shall be no greater than –38 dBm/Hz; the upper end of this passband depends on whether the signal is for initialization (see 7.15.1) or steady state (see 7.15.3).

The pass band ripple shall be no greater than +3.5 dB; the maximum PSD of –34.5 dBm/Hz applies across the whole band from 25 kHz to 138 kHz; the minimum applies only over the used passband.

The group delay variation over the pass band shall not exceed 50μs.

7.14.2 Low frequency stop band rejection

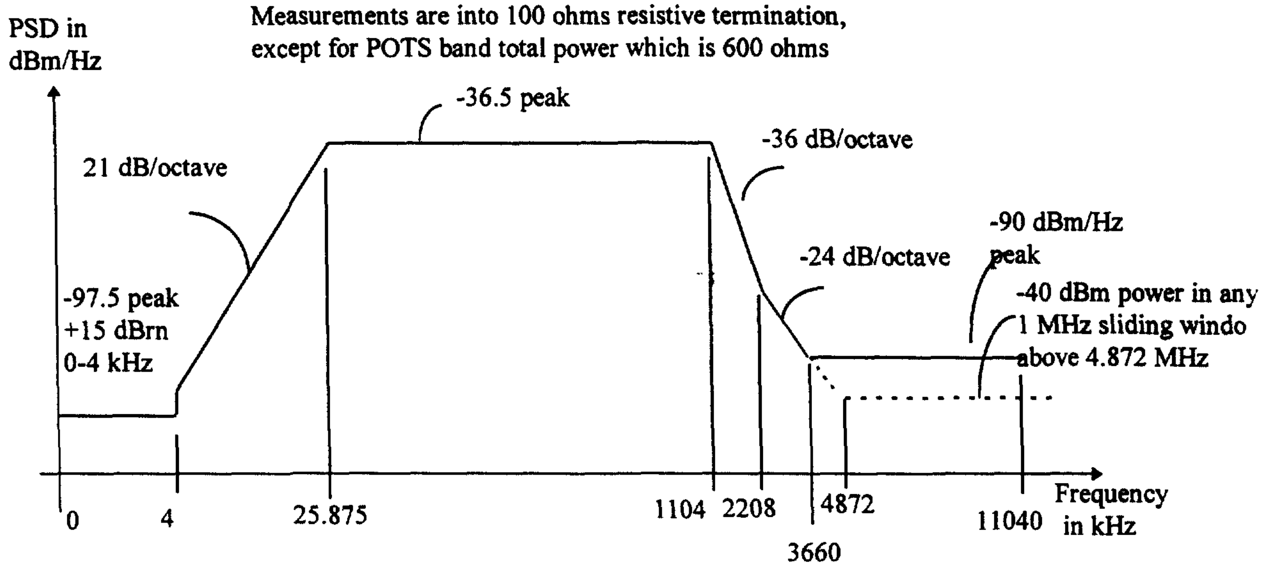
The total power in the voice band (0 Hz to 4 kHz) shall not exceed +15 dBrn (see 12.4 for the method of measurement).

In the transition band from 4 kHz to 25.875 kHz, the maximum PSD is given by a straight line on a log scale from -92.5 dBm/Hz, at just above 4 kHz, to -34.5 dBm/Hz at 25.875 kHz; that is -92.5 + 21.5xlog(f/4)/log(2) dBm/Hz.

Appendix B: Downstream Spectral Response from T1 LB 652

6.14 Transmitter spectral response

Figure 25 shows a representative spectral response mask for the transmitted signal. The low frequency stop band is defined as the POTS band; the high frequency stop band is defined as frequencies greater than 1.104 MHz.



FREQUENCY BAND, kHz	EQUATION FOR LINE, dBm/Hz
0 - 4	-97.5, +15 dBrn 0-4 kHz
>4 - 25.875	-92.5 + 21 × log (f/4)/log(2)
25.875 - 1104	-36.5
1104 - 2208	-36.5 - 36 × log(f/1104)/log(2)
2208 - 3660	-72.5 - 24 × log(f/2208)/log(2)
3660 - 11040	< - 90 peak, ith < -40 dBm power in any 1 MHz sliding window above 4.872 MHz

Figure 25 – ATU-C transmitter PSD mask

6.14.1 Passband PSD and response

The average PSD within the used passband shall be no greater than –40 dBm/Hz reduced by power cut-back in multiples of 2 dB; the lower end of this passband depends on whether echo cancelling or FDD is used, and is manufacturer discretionary; the upper end depends on whether the signal is for initialization (see 6.15.1) or steady state (see 6.15.3);.

The pass band ripple shall be no greater than +3.5 dB; the maximum PSD of (–40 – 2n + 3.5) dBm/Hz applies across the whole band from 25 kHz to 1104 kHz; the minimum applies only over the used passband.

The group delay variation over the pass band shall not exceed 50μs.

6.14.3 High frequency stop band rejection

The PSD shall decrease at 36 dB/octave from (-40 dBm/Hz + 3.5 dB) at the band-edge (1.104 MHz) to (-76 dBm/Hz +3.5 dB) at 2.208 MHz, and at 24 dB/octave from 2.208 MHz until reaching a floor of -90 dBm/Hz at 3.660 MHz. In addition, the power in any 1 MHz sliding window from 4.872 MHz to 11.04 MHz shall not exceed -40 dBm.

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